



# **U.S. Software and Computing Overview**

**James Shank**



DOE/NSF Review of the U.S. LHC Research Program

FNAL

9-11 April, 2002

# Outline



- International and U.S. ATLAS
  - Organization
  - U.S. ATLAS
- Status/Recent successes
  - Software
  - Facilities
  - Grid efforts
    - The LHC Computing Grid Project
  - Physics

# International ATLAS



- Computing Oversight Board
- Computing Steering Group
  - Matrix of detector/task orientation
- PBS structure gives tasks, schedules, resource loading
  - Maps directly onto U.S. ATLAS WBS
  - Planning officer is now Torre Wenaus (U.S. ATLAS SW Mgr.)
- Software deliverables delineated in Software Agreements
- Major milestones associated with releases, data challenges
- New Simulation coordinator: Andrea Dell'Acqua (CERN)



# ATLAS Detector/Task matrix

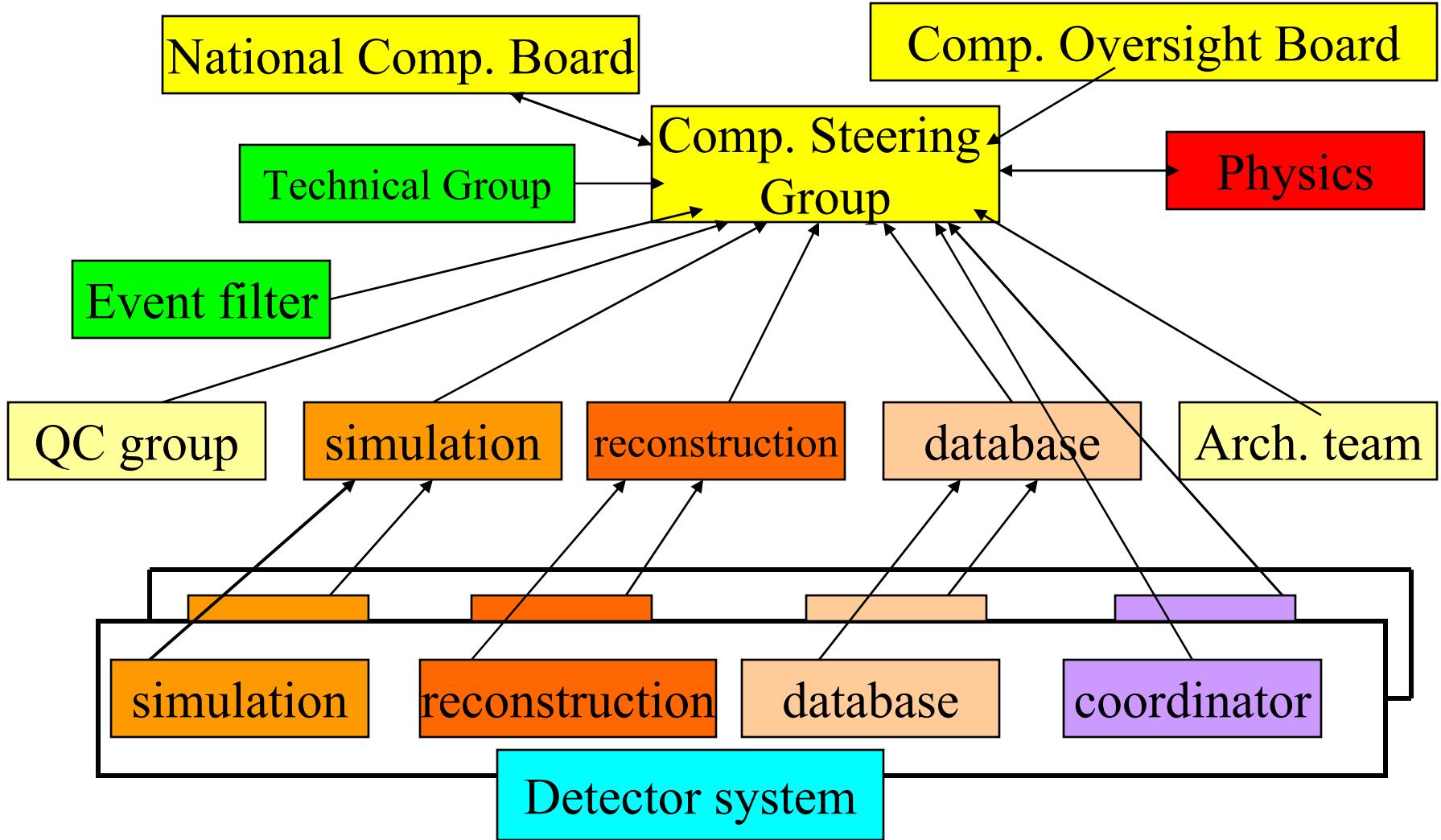
	Offline Coordinator	Reconstruction	Simulation	Database
Chair	N. McCubbin	D. Rousseau	A. Dell'Acqua	D. Malon
Inner Detector	D. Barberis	D. Rousseau	F. Luehring	S. Bentvelsen
Liquid Argon	J. Collot	S. Rajagopalan	M. Leltchouk	R. Sobie
Tile Calorimeter	A. Solodkov	F. Merritt	A. Solodkov	T. LeCompte
Muon	J. Shank	J.F. Laporte	A. Rimoldi	S. Goldfarb
LVL 2 Trigger/ Trigger DAQ	S. George	S. Tapprogge	M. Weilers	A. Amorim
Event Filter	F. Touchard	M. Bosman		

Physics Coordinator: F.Gianotti

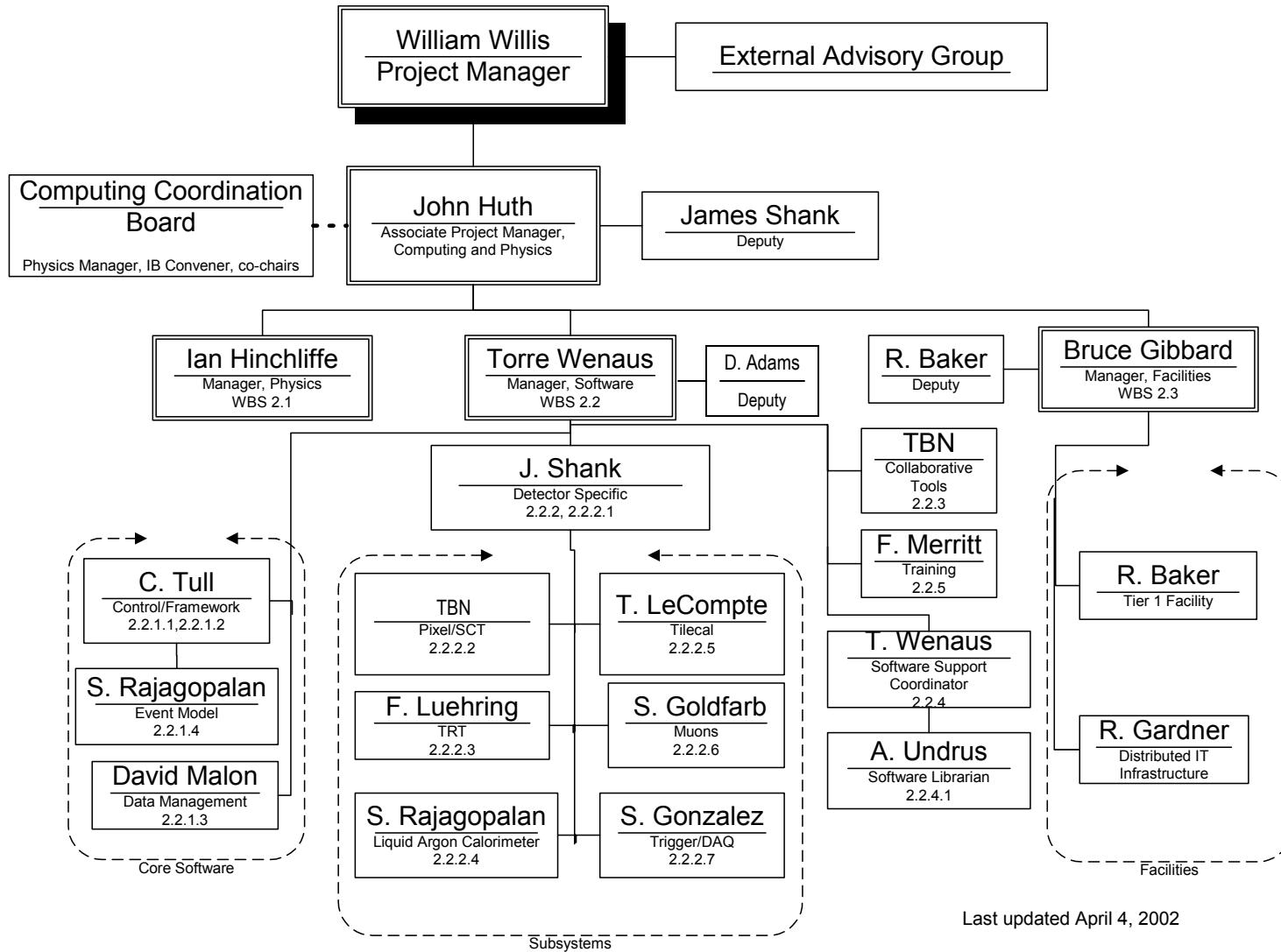
Chief Architect: D.Quarrie

CSG

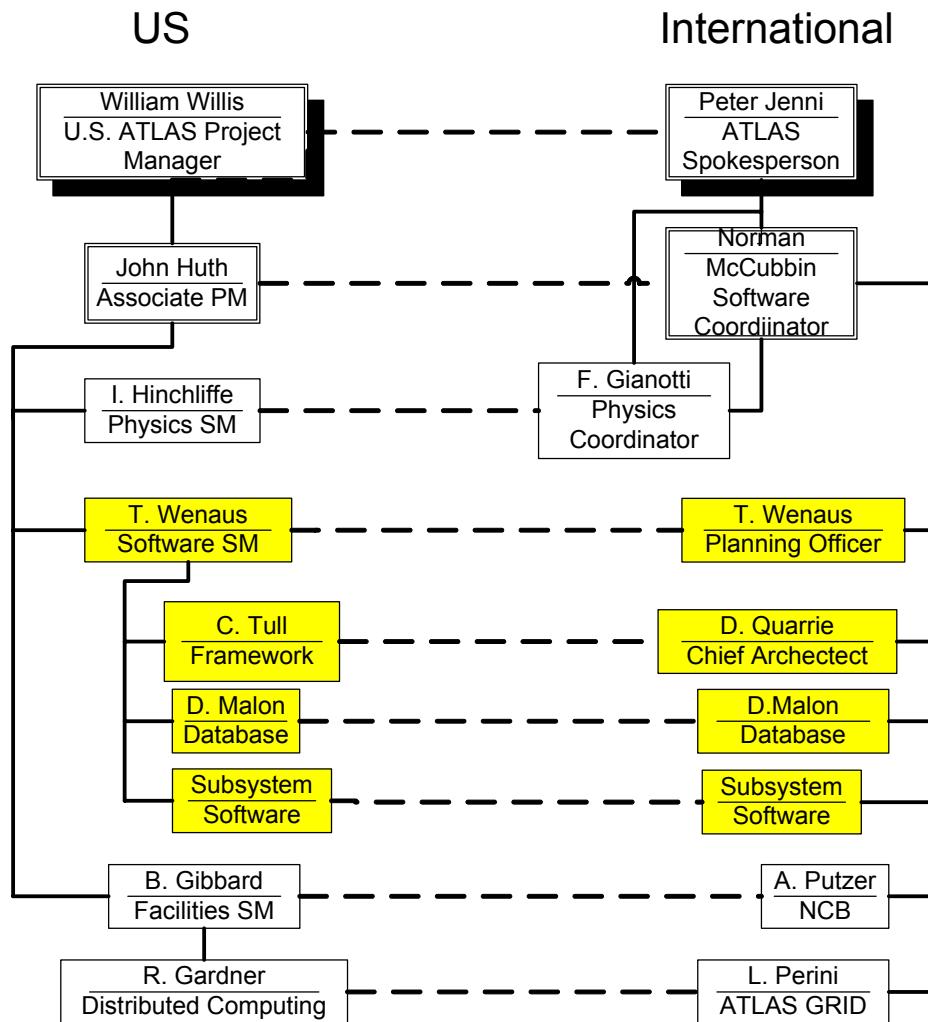
# International ATLAS Computing Org.



# U.S. ATLAS Physics & Computing Program



# U.S. ATLAS - ATLAS Coordination



## US roles in Int'l ATLAS software:

**D. Quarrie (LBNL), Chief Architect**

**D. Malon (ANL), Database Coordinator**

**P. Nevski (BNL), Geant3 Simulation Coordinator**

**H. Ma (BNL), Raw Data Coordinator**

**C. Tull (LBNL), Eurogrid WP8 Liaison**

**T. Wenaus (BNL), Planning Officer**

**J. Shank(BU), Muon Software coordinator**

# Recent Events



- Progress toward coherent, integrated effort
  - First Software Agreement Signed! (Control/framework)
    - Second one in progress (QA/QC)
- Recent progress driven by a series of Data Challenges:
  - Data Challenge 0 happening now, ends in a couple of weeks.
    - Continuity test – Athena (the ATLAS framework sw) release
  - DC 1 July, 2002
    - Delayed, but more functionality in Athena
  - DC 2 in 03.
- Personnel Changes
  - D. Malon now solo data management leader
  - Torre Wenaus now ATLAS planning officer and LCG Applications leader.
    - David Adams named Torre's deputy as US software manager.

# U.S. ATLAS Goals



- Deliverables to International ATLAS and LHC projects
  - Software
    - Control/framework (SW agreement signed) (Athena)
    - Portion of data management
    - Event Model
    - Collaboratory tools
    - Detector subsystem reconstruction
  - Grid integration
  - Computing resources devoted to data analysis, simulation
    - Tier 1, Tier 2 centers
- Support of U.S. ATLAS Physicists
  - Computing resources
  - Support functions (librarian, nightly builds, site support)
- Current Effort (02): 10.5 FTE on core sw (~22% of overall ATLAS effort)

# U.S. ATLAS Developments



- Physics
  - Up-to-date physics generators working in Athena
- Athena (control/framework)
  - DC 0 release
  - Incorporation of G4 interface
    - Previous problem with alternate framework for simulation (FADS/Goofy) going away
- Database
  - D. Malon convening LHC Computing Grid Project RTAG for data management
    - Specifies near-term common project
  - Hybrid Event Store, Root I/O deployment
- Facilities
  - Ramp delayed by funding profile, DC preparation reduced scope
- Common grid plan worked out
- Librarian support, nightly builds at BNL (from CERN)

# Athena developments



- Migration to new configuration management tool (CMT) complete and successful.
- Data Dictionary prototype.
  - Atlas Data-definition Language automates persistency service
- Pile-up framework infrastructure
  - Prototype for one sub-system
- New version of Gaudi, the underlying framework for ATLAS and LHCb
- Geant 4 integration prototype

# Event Model



- New backend for StoreGate
  - Adhering to interface agreed with LHCb
  - Significant data access time improvement
- New features in StoreGate
  - Memory dumps, read-only stores
- New AthenaServices
  - Controlling event loop
  - I/O streams
- New transient representation for fast and efficient access to raw data in ROI needed for HLT.
- DataLinks describing object-object references now persistent in Objectivity
- Progress on the interface between StoreGate and the Hybrid Event Store
  - HES: Streaming I/O plus a relational DB

# Data Management



- DB support for DC0
  - GEANT 3 simulation
  - ATLFAST simulation
  - Objectivity I/O provided by U.S. team
- Persistence service for the new StoreGate backend
- ROOT persistency service for Athena released
  - ROOT persistence for the current event model is underway
- Magda metadata management tool (PPDG) demonstrated in DC0
  - Integration with GDMP and GLOBUS tools in progress
- DB Architecture document exists now
  - Overall Data Management Architecture Design Document being prepared.

# Facilities Schedule



- LHC start-up projected to be a year later
  - 2005/2006 → 2007
    - 30% facility in 07
    - 100% facility in 08
- ATLAS Data Challenges (DC's) have, so far, stayed ~fixed
  - DC0 – Nov/Dec 2001 –  $10^5$  events
    - Software continuity test –Almost finished.
  - DC1 – Feb/Jul 2002 –  $10^7$  events
    - Delayed 3 months
    - ~1% scale test
    - 2 phases:
      - data production for the high level trigger
      - Test of new sw + facilities.
    - Data used for US ATLAS Grid testbed integration tests
  - DC2 – Jan/Sep 2003 –  $10^8$  events
    - ~10% scale test
    - A large-scale functionality & capacity exercise
    - A high level of US ATLAS facilities participation is deemed very important
    - Will be delayed at least 6 months.

# Facilities



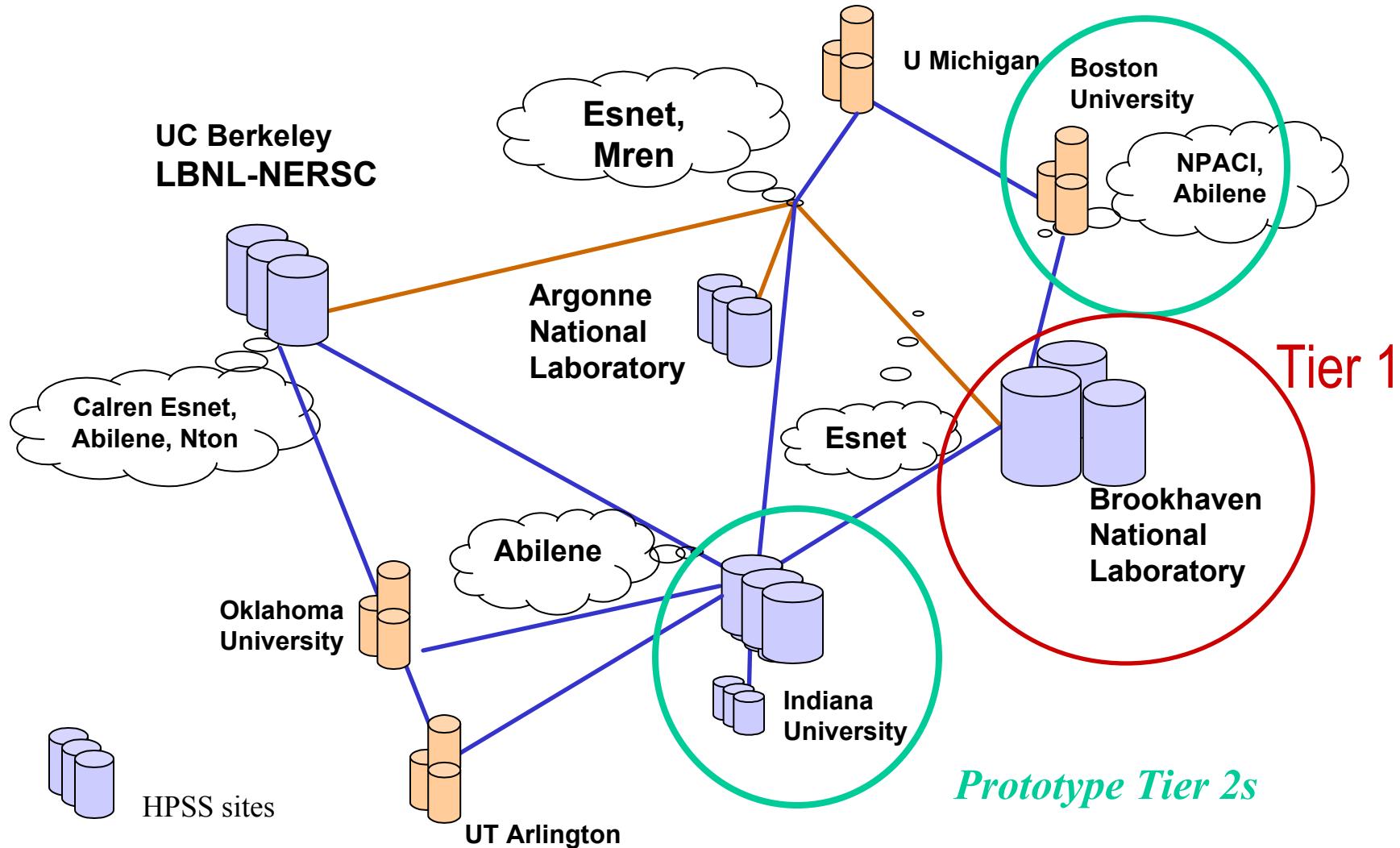
- Tier 1 particularly hard hit by budget shortfall
  - Delays in hiring
  - Scalable online storage prototype work delayed approx. 7 mos.
  - DC2 scale still under discussion.
  - Major usage of Tier 1 for shielding calculations
- Anticipate major usage in DC's and in grid tests
- Examination of tape vs. disk for event store at start of data taking
- Tier 2
  - Selection of first prototype centers (I.U., B.U.)
  - iVDGL funding of prototype hardware
  - Deployment of SW on testbed sites in progress

# Collaborating Groups



- iVDGL funding (Tier 2 personnel, Hardware) approved
  - But 50% cut in hardware relative to original planning
- PPDG effort in progress
- ITR funding of Indiana (grid telemetry)
- Integrated planning on software, facilities for grids
- Liaisons
  - GriPhyN/iVDGL – R. Gardner (J. Schopf CS liaison)
  - PPDG – J. Huth (T. Wenaus on steering; J. Schopf CS liaison)
  - EU Data grid – C. Tull
  - HEP Networking – S. McKee

# US ATLAS Grid Testbed



# US ATLAS Tier 1 Facility

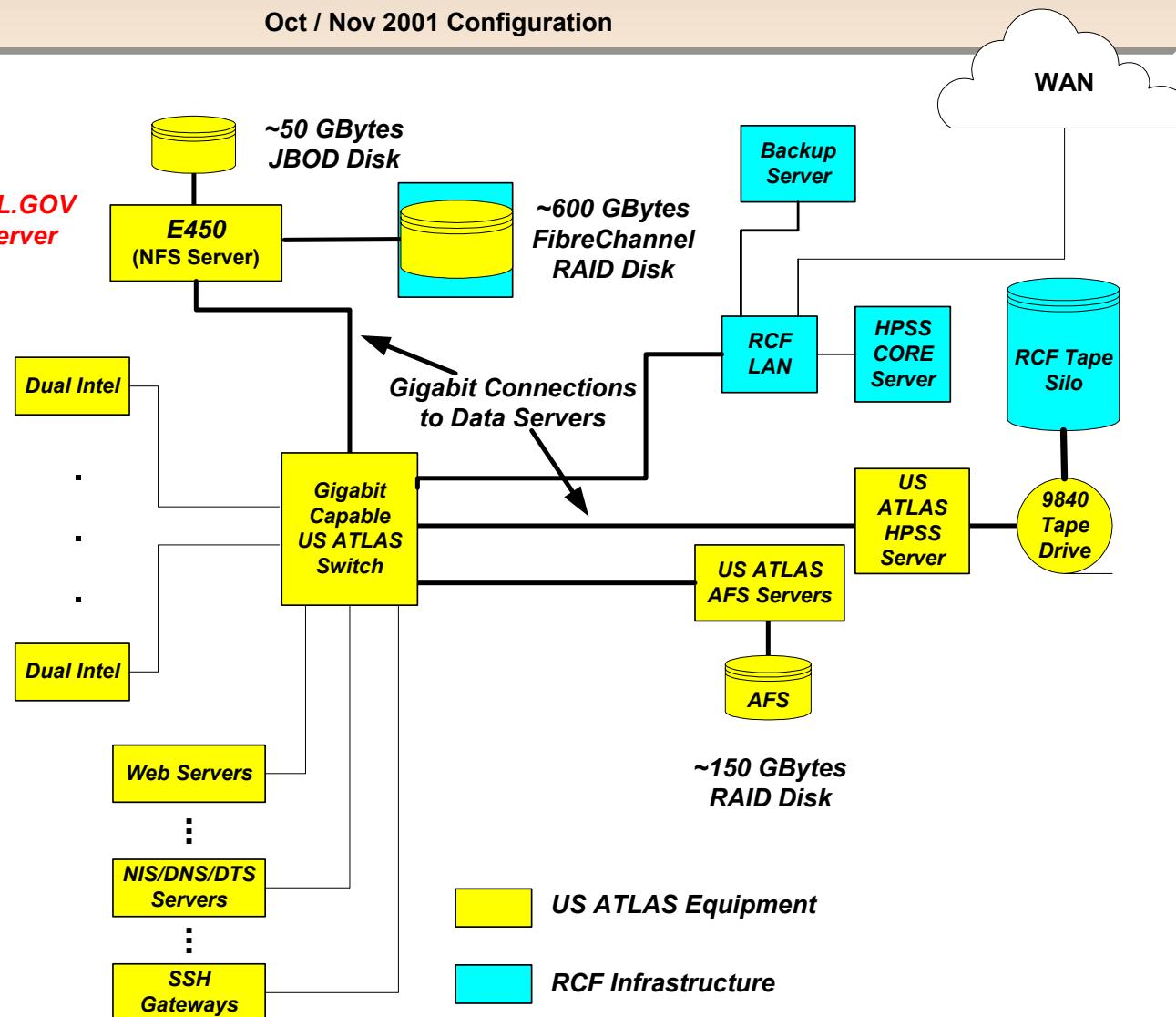
Oct / Nov 2001 Configuration



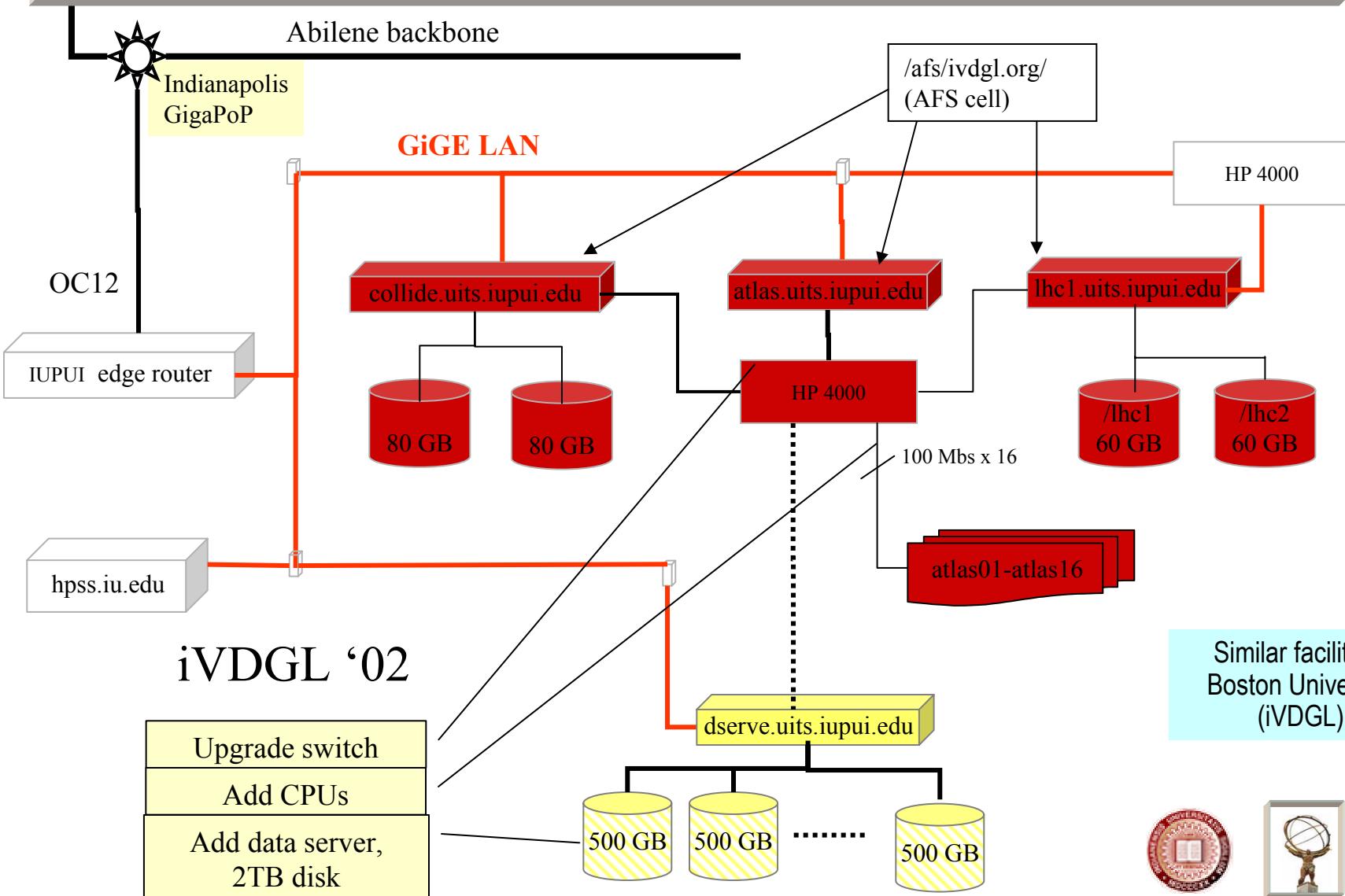
- **XXX.USATLAS.BNL.GOV**
- **Objectivity Lock Server**

**62 Intel/Linux**  
**Dual 700/450 MHz**  
**256/512 MBytes**  
**9/18 GBytes**  
**100 Mbit Ethernet**  
**(3,200 SPECint95)**

- LSF
- AFS
- Objectivity
- Gnu etc.



# Indiana University P-Tier 2 Center



# Grid Efforts

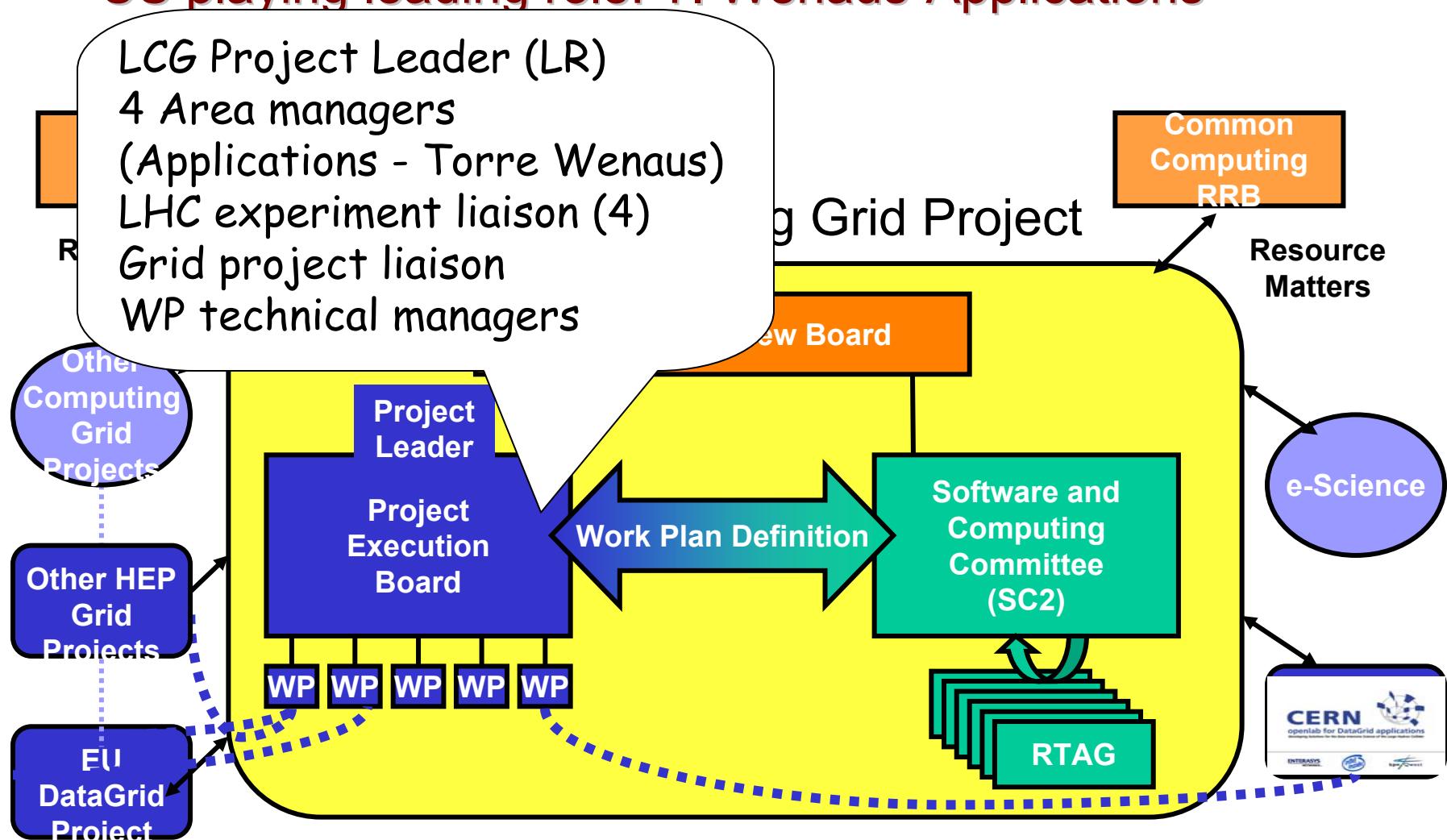


- Many sources of effort/shared
  - GriPhyN/iVDGL/PPDG/EU activities/New CERN mgmt.
- Common U.S. ATLAS plan
  - Use existing tools as much as possible
  - Use existing platforms as much as possible
  - Gain experience in
    - Replica catalog
    - Metadata description
    - Deployment/release of tools
  - Philosophy is to gain expertise, not await a grand international synthesis
- Large US ATLAS Role in the LHC Computing Grid (LCG) Project.

# The LHC Computing Grid Project



- US playing leading role: T. Wenaus-Applications



# Summary



- Much progress on many fronts
  - Coherent software chain emerging from DC0 → DC1
- Effort in core software vital to overall ATLAS
  - Our leading role in ATLAS core software will result in a leading role for US physicists in data analysis in 2007.
- Current US core sw effort commensurate with overall US role in ATLAS
  - Takes advantage of our existing expertise.
- Funding profile is still an issue
  - Personnel ramp
  - Ramp of facility and participation in DC1,2
    - We MUST have Tier 1/2 facilities early enough to be relevant